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Operational ERDB database and User manual

D.2.3

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Document Control Sheet**Title:****Executive Summary:**

One of the main objectives of the Eco-REFITec project is the development of a comprehensive database to include eco-innovative processes, materials and modules that might be of relevance to improving the performance of ship repair industry, especially to address the future retrofit activities to be carried out in small & medium size shipyards. For this purpose, an entire work package was dedicated (WP2).

Currently there are available free databases for conducting Life Cycle Assessment like the European ELCD database, the U.S. Life Cycle Inventory Database and CPM LCA Database. Also there are available commercial databases like EIME of Bureau Veritas CODDE, GaBi database of PE International GmbH or Umberto library of ifu Hamburg GmbH that are well maintained and include a wide range of analysis tools.

The purpose of developing the present database was an identified lack of information on existing eco-innovative processes, materials and modules, easily available for small and medium enterprises.

As the project is ongoing, the database was developed based on the received inputs from WP 1 and WP 2, and it is preparing the grounds for its implementation into the tools for evaluation and management of eco-innovative retrofit processes (WP3) and for the Life Cycle Analysis (WP5) integration.

In addition, the validation processes from WP 4 will serve as new inputs for the database in terms of optimization and quality of information.

The database includes an archive of the newsletters provided by WP 6, and has a module dedicated for the distribution of the newsletter by e-mail to registered and subscribed users.

The value added to the Eco-REFITec project by the development of the database (ERLCA-DB) is the focused approach to the shipbuilding and ship repair sectors, addressing the small and medium enterprises, compared to other existing databases which offer a general inventory or are focused on other sectors of activities.

The Eco-REFITec Database will additionally include Value Engineering and LCA tools which will be developed in order to use the existing inputs from the database, and the available inputs from other external datasets.

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1 Introduction

For the development of a science base approach in the decision making process enabling eco-innovation in Ship Repair industry there is a fundamental need for an integrated decision support platform.

The entire decision process could rely on information, models and tools that might be available for the users in an appropriate, accessible, framework. The development of such a framework is the aim of Eco-REFITEC WP2.

1.1 Concretization of Task Description

Eco-REFITEC WP2 is mainly focused on the development of a specific innovative and dedicated comprehensive database which shall include information on eco-innovative technologies and equipment, which should help to identify technological eco-innovations (processes, materials and modules), that might be of relevance to improving the performance of the ship repair industry, while especially addressing the future retrofit activities to be carried out in small & medium size shipyards.

Therefore, the main objective of this task is to develop specific tools and technologies to support eco-innovation in the Ship Repair Sector.

A draft of the database has been developed, considering the necessities of the end-users which shall benefit from the existing information, as well as from the tools embedded in it. In order for the data base to automatically expand with external inputs, the data base shall be fitted with an automatic data gathering application.

The purpose of the task is to develop a Database to share and make available all the technological Eco-Innovations found during the project.

In this deliverable it is presented the database developed which is accessible on internet. The access to the database is currently done by accessing the following temporary address: <http://92.55.144.224/ecorefitec>. During the implementation of the project, after the consultation within the consortium, there shall be identified a suitable address for the Database Web Access.

1.2 Related ECO-REFITEC Tasks

All WP2 tasks are related with the data base. In particular that intended develop a value engineering methodology and those trying to identify eco innovative processes, structures, materials and equipment modules appropriate to be used in repair/retrofit and conversion of vessels.

Based on the identified necessities from T2.2-T2.5, the data base was tailored both for ease of access for end-users, as well as for the information administrators.

The Eco-REFITEC cases studies are also related with the data base.

2 Scope of the Database

Basically a database is a system intended to ORGANIZE, STORE, and RETRIEVE large amounts of DATA easily. It consists of an organized collection of data for one or more uses, typically in digital format. The data aimed to be included in the ERLCA Database are typically organized to model relevant aspects of ship repair activities (for example, the ship repair processes, modules, materials and structures), in a way that supports eco-innovative processes requiring this information.

According IT terminology the term database is correctly applied to the data and their supporting data structures, and not to the database management system (DBMS). The database data collection with DBMS is called a database system.

A database management system (DBMS) consists of software that operates databases, providing storage, access, security, backup and other facilities.

Usually DBMS does not have a very friendly interface and in order to operate the database by using a DBMS the user will need to have very good IT knowledge in the field of code writing and scripting. In this respect, a friendly interface must be developed, usually like an application or website. The scope of this application is to offer a user friendly view of the items included in database, to offer possibilities for adding new data, modify existing data, export data. Beside of these basic capabilities, a database interface must be tailored to the user application and context of using the data stored in the database.

As a consequence of the research activities that have been carried out within the Eco-Refitec project it came out the need to use an open source database management system, the MySQL DBMS because of its scalability and flexibility, high performance, high availability, robust transactional support, web and data warehouse strengths, strong data protection, comprehensive application development, management easiness, open source freedom, all of these correlated with the lowest total cost of ownership.

As the interface it has been developed a web application where the user have the capabilities to access the information by using the database catalogue, contribute to the database, and perform value analyses on the data included in the database. Further on the users will have access to the best practices developed in the project and will have the possibilities to access the life cycle assessment for the test cases developed in the Eco-Refitec project.

THE MAIN SCOPE OF THE ECO-REFITEC DATABASE IS TO SHARE AND MAKE AVAILABLE ALL THE TECHNOLOGICAL ECO-INNOVATIONS DEVELOPED DURING THE PROJECT. In this respect a friendly tool to facilitate the upload in the database the eco-innovation processes, modules, materials and structures. Also, was integrated a full accessible catalogue that includes all eco – innovation processes, materials, modules and ship retrofit practices from the database.

In order to keep the target group informed about the latest eco-innovation processes, materials, modules and ship retrofit practices included in the database, four periodic newsletters will be conceived. The newsletter will be generated automatically with the information from the database and will be sent to target group by e-mail.

Another module of the database is a tool to publish the information from the database using self described XML. In this way the project will support the community to develop new applications using information extracted from the Eco-Refitec database.

The module for adding items in the database is extended with an automatic updating tool based on appropriate meta-data ontology (standards, markets, supply chain) that is developed in order to collect information published on the web. This tool will also play an important role to determine the index of trust of items included in the database. This is described in more details in chapter 4: Assessment of data from the Database.

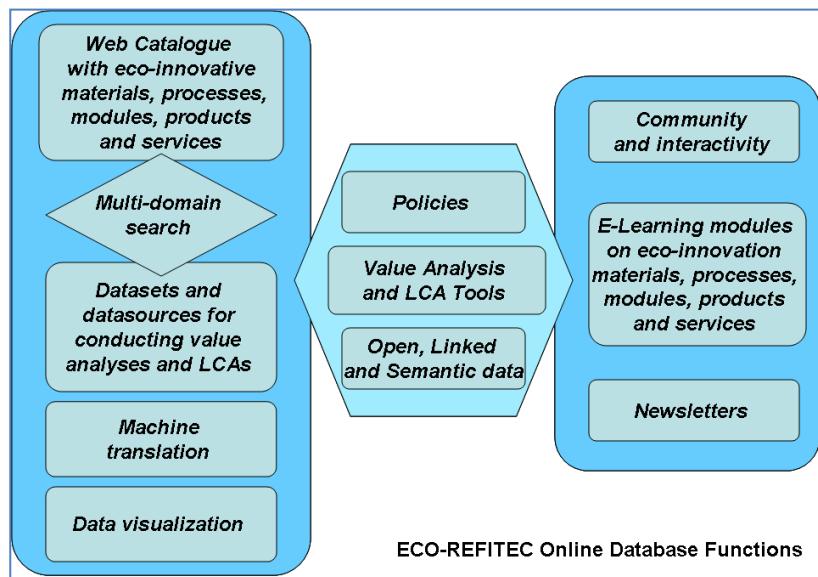


Figure 1: ECO – REFITEC Data Base Functions

3 Testing the functionalities of the ERLCA Database

The functionalities of the ERLCA Database will be tested using the case studies that will be performed in WP4 as listed in D1.4.

For covering all features of the ERLCA Database the testing procedures will be concentrated on the following generic ship repair jobs:

1. Painting
2. Process replacing – glass blasting
3. Process replacing – laser welding
4. Process replacing – bonding
5. Anti corrosive coating
6. Steel plate replacing
7. Steel plate replacing with I-Core
8. Steel plate replacing with composite
9. Steel plate replacing with Biodegradable materials
10. On board Ballast Water Treatment Plant Retrofit
11. Fuel replacement with low sulfur fuels
12. Conversion to LPG fuel
13. Conversion to CNG fuel
14. Conversion to bio fuels
15. Post treatment of exhaust gases
16. On board energy efficiency
17. Cogeneration
18. Retrofit of firefighting systems with CO₂ free systems
19. Retrofit of oil lubrication system for shaft lines
20. Retrofit of bilge water system

During the implementation phase of the Eco-Refitec work packages the above mentioned list will be updated and more details will be available in the next version of the D2.3.

4 How to use the Database

In this section are described two facets of the database: the actual structure of the database and the WEB Access structure, used for interfacing with the information present in the database.

4.1 Database structure

The database was developed considering the needs identified during the project from the partners, equipment producers, shipyards, ship designers and other actors involved in the retrofit processes.

The database was designed to be deployed on 4 vertical levels (**;Error! No se encuentra el origen de la referencia.**), each level going into more detail for each item that is introduced into the database.

The entire database is designed to expand by itself, as new data is added. This is done by the users, as in order to add new data, it is necessary to add new fields into the database (see 4.2.2 Database Catalogue).

The first level (**;Error! No se encuentra el origen de la referencia.**) consists of general information regarding: Best Practices, Equipment Categories, Materials and Structures Categories, Technologies Categories, Engineering Services Categories, Eco-innovation Shipyard Categories. Each of the enumerated categories contains a number of basic information which was identified in the beginning of the database development.

The second level contains the categories and the description template for the items in Level 1.

The third level stores the properties of the items from Level 1, described in Level 2.

The forth level contains in-depth details of the properties for each subcategory.

Level 1	Best practices	Equipments categories	Materials and structures categories	Technologies categories	Engineering services categories	Eco innovation shipyard categories																								
	<table border="1"><tr><th>PK</th><th><u>id</u></th></tr><tr><td>FK1 FK2</td><td>name shipyard category template</td></tr></table>	PK	<u>id</u>	FK1 FK2	name shipyard category template	<table border="1"><tr><th>PK,FK2,FK3</th><th><u>id</u></th></tr><tr><td>FK1</td><td>name template</td></tr></table>	PK,FK2,FK3	<u>id</u>	FK1	name template	<table border="1"><tr><th>PK,FK2</th><th><u>id</u></th></tr><tr><td>FK1,FK3</td><td>name template</td></tr></table>	PK,FK2	<u>id</u>	FK1,FK3	name template	<table border="1"><tr><th>PK,FK2,FK3</th><th><u>id</u></th></tr><tr><td>FK1</td><td>name template</td></tr></table>	PK,FK2,FK3	<u>id</u>	FK1	name template	<table border="1"><tr><th>PK,FK1,FK2,FK3</th><th><u>id</u></th></tr><tr><td></td><td>name</td></tr></table>	PK,FK1,FK2,FK3	<u>id</u>		name	<table border="1"><tr><th>PK,FK1,FK2</th><th><u>id</u></th></tr><tr><td></td><td>name</td></tr></table>	PK,FK1,FK2	<u>id</u>		name
PK	<u>id</u>																													
FK1 FK2	name shipyard category template																													
PK,FK2,FK3	<u>id</u>																													
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PK,FK1,FK2	<u>id</u>																													
	name																													

Figure 4-1 – First level of the Database structure

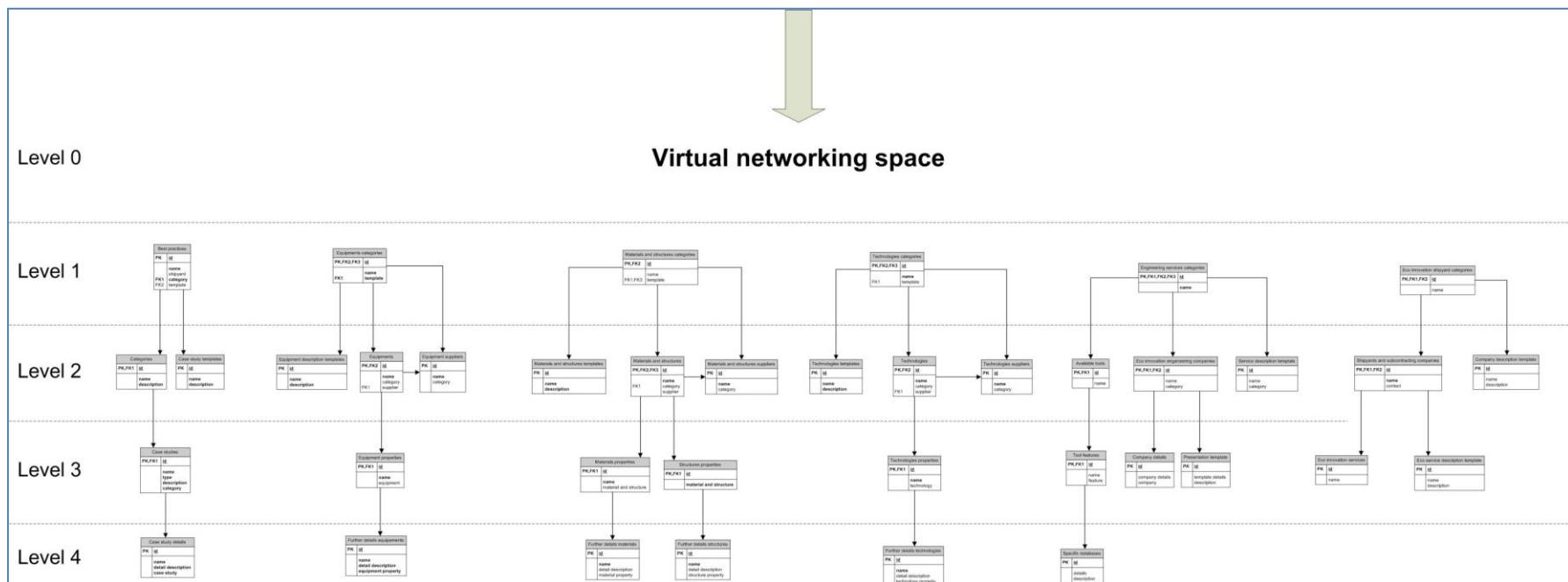


Figure 4-2 – Database structure

4.2 WEB Access structure

The access to the database is currently done by accessing the following temporary address: <http://92.55.144.224/ecorefitec>. During the implementation of the project, after the consultation within the consortium, there shall be identified a suitable address for the Database Web Access.

The web access home page offers the possibility for different users to access the database and to use the tools developed during the project.

The main page describes the background for the implementation of the database and the objectives of the project.

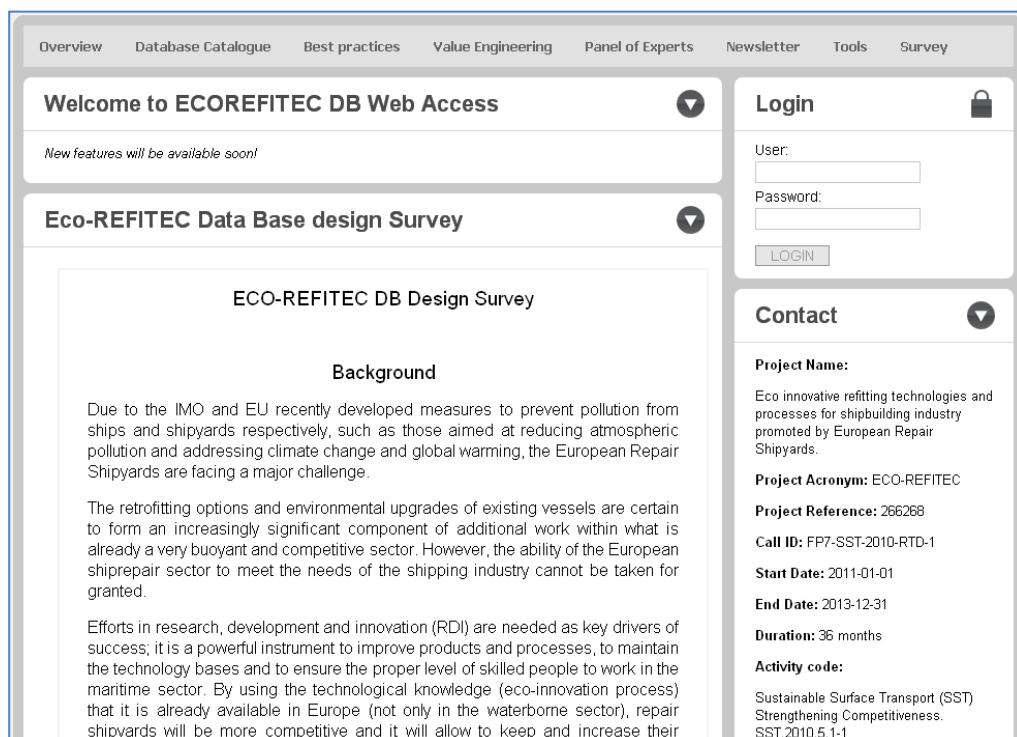


Figure 4-3 –Database Web Access – Welcome Page

In order to further access the database and to input new data, the DB web access offers the possibility for registered users to login and add, edit or delete information, as it will be described below.

4.2.1 OVERVIEW

The page includes a short overview of the project database and its functions.

In addition, it contains the links to the online survey which has the purpose of gathering data regarding the impact of the database.

4.2.2 DATABASE CATALOGUE

The Database Catalogue is split into four main sub-pages:

- Eco-innovation processes for ship retrofit
- Eco-innovation structures and materials for ship retrofit
- Eco-innovation modules for ship retrofit
- Database search engine

By accessing one of these pages, the user can view comprehensive information of the specific items that are included in the database.

Process category	Process	Supplier	Equipment	
Welding	Shielded metal arc welding (SMAW)	ESAB	Caddy™Arc 251i	View
Welding	Shielded metal arc welding (SMAW)	Hobart	Stickmate® LX 235 AC / 160 DC	View
Welding	TIG welding	Lincoln Electric	Invertec® V311-T AC/DC TIG Welder	View

Figure 4-4 – Database Catalogue, view for not registered users

Also, according to the user access rights, he or she can contribute to the database by proposing the input of new items. When logged in, the “Add new” button (process, material, structure or module) appears in the upper right corner.

Process category	Process	Supplier	Equipment	
Welding	Shielded metal arc welding (SMAW)	ESAB	Caddy™Arc 251i	View
Welding	Shielded metal arc welding (SMAW)	Hobart	Stickmate® LX 235 AC / 160 DC	View
Welding	TIG welding	Lincoln Electric	Invertec® V311-T AC/DC TIG Welder	View Edit

Figure 4-5 – Database Catalogue, view for registered users

4.2.2.1 Add new process

When logged in, go to the “Database Catalogue” and from the drop-down list choose the “Eco-innovation processes for ship retrofit”.

The screenshot shows a web-based application interface. At the top, there is a navigation bar with links: Overview, Database Catalogue, Best practices, Value Engineering, and Panel of Experts. Below the navigation bar, the title "Eco-Innovation Processes for Ship Retrofit" is displayed. In the upper right corner of the main content area, there is a green button with the text "Add new process into the DB". The main content area contains a table with five columns: Process category, Process, Supplier, Equipment, and actions (View or View Edit). The table lists three welding processes:

Process category	Process	Supplier	Equipment	
Welding	Shielded metal arc welding (SMAW)	ESAB	Caddy™ Arc 251i	View
Welding	Shielded metal arc welding (SMAW)	Hobart	Stickmate® LX 235 AC / 160 DC	View
Welding	TIG welding	Lincoln Electric	Invertec® V311-T AC/DC TIG Welder	View Edit

Figure 4-6 – Page for viewing existing processes and adding new ones

In the upper right corner you will find the “Add new process into the DB” button.

By clicking on it a step-by-step wizard will be launched.

The screenshot shows the first step of a wizard titled "Add a new process for ship retrofit". The top navigation bar includes links: Overview, Database Catalogue, Best practices, Value Engineering, Panel of Experts, Newsletter, Tools, and Survey. On the right side, there is a "Welcome back" panel showing the user is logged in as Laurentiu Oancea, with links for Account Settings and logout. The main content area for Step 1 has a title "Step 1: Please choose the category of the process". It includes a dropdown menu labeled "Category:" with the placeholder "Please select from this drop-down list" and a text input field below it with the placeholder "If the category of process it's not in the list above, please, enter the name of the category in the field below". A green "Next step" button is at the bottom left.

Figure 4-7 – Wizard for adding a new process for ship retrofit – Step 1

In the **first step**, the user has the option to choose an existing process, or if there is the need to add a new process which is not present in the dropdown list, it can be added in the provided field below the dropdown box.

Figure 4-8 – Wizard for adding a new process for ship retrofit – Step 1 – Choose a category

Please note that if you add a new type of process, in the first phase it will have the status of “proposed”. This is done in order to assure that only reliable data is introduced. The approval is given by the administrator of the database, while in the meantime the user can proceed to the next step.

If at this **first step** there is no selection, or the proposal of a new process category, an error will be displayed and you will not be able to proceed to the next step.

In the **second step** the user is prompted to input the process type. This can be done by using a process which already exists, or by using the second field to propose a new process type.

Figure 4-9 – Wizard for adding a new process for ship retrofit – Step 2

If at this **second step** there is no selection, or the proposal of a new process type, an error will be displayed and you will not be able to proceed to the next step.

In the **third step**, the user is able to input detailed information for the process. The first part of the page shows a note with a few instructions on how to fill the form.

Add a new process for ship retrofit

Step 3: Please enter the information regarding the process

Please note:

If you could not find a proper field where to insert the information, please press on the add new field button and proposed another field

If you just added a new category of processes it is possible to don't have any available fields. Please be free and propose fields for this category of processes

You can come back to this item in order to continue editing it by typing the following address:
<http://92.55.144.224/ecorefitec/index.php?task=addprocess&step=3&id=47&passkey=4b505a0f5657458cffcc3794503e0bd3>

Figure 4-10 – Wizard for adding a new process for ship retrofit – Step 3

In addition, as the new process is added, a direct link to the information is provided, allowing the user the possibility of returning at any time to edit the information he or she supplied to the database.

Note: The users can edit only the information that was entered from their account.

In the second part of the page, the chosen process category and process type will be displayed. Next there will be a series of available properties to be filled. The properties are generated automatically based on the process description template.

The process description template contains the list of recommended properties necessary for uploading a process. This template is dynamic, and the user could request to add a new property. If the administrator approves this, the property will be added to the template of the specific process category.

Category: Coating

Process: Airless System

The name of the equipment

The equipment supplier

Please select from this drop-down list

The name of the equipment supplier

The website of the equipment supplier

Equipment Cost (\$)

Coat Delivery Rate (gpm)

Save **Add new field**

Figure 4-11 – Wizard for adding a new process for ship retrofit – Step 3 – Fields

In order to add a new field, you simply need to click on the “Add new field” button from the lower right corner of the form. When you press the button, the initial form will be extended and the “Add new field” form will be displayed.

The screenshot shows a modal window titled "Add a new field". It contains the following fields:

- Field name:** A text input field.
- Required:** A radio button group with "Yes" selected and "No" as an option.
- Description:** A text input field.
- Value:** A text input field.

At the bottom of the window are two buttons: a green "Save" button on the left and a green "Add new field" button on the right.

Figure 4-12 – Wizard for adding a new process for ship retrofit – Step 3 – Add new field

In the “Field name” text box you need to enter the property name. Following this, you need to choose if this property/field is mandatory to be filled or not for the other processes. There is also a box provided for the description of the property. The value field is optional, but if you type a value it will be saved. This value can be edited later, as well.

For example, if the new property is “Approval date”, the description should be detailed such as “The date of approval by IMO”, and the value could be “10/22/2012” or “10.22.2012”.

If you want to save the information entered you should press the “Save” button from the lower-left corner of the form.

4.2.2.2 Add new structure or material

When logged in, go to the “Database Catalogue” and from the drop-down menu list choose the “Eco-Innovation Structures and Materials for Ship Retrofit”.

The screenshot shows a web-based catalogue interface for "Eco-Innovation Structures and Materials for Ship Retrofit". The top navigation bar includes links for Overview, Database Catalogue, Best practices, Value Engineering, and Panel of Experts. The main content area has a title "Eco-Innovation Structures and Materials for Ship Retrofit" with a dropdown arrow icon.

Below the title are two green buttons:

- Add a new structure into the DB**
- Add a new material into the DB**

The interface is divided into sections:

- Materials**: A table with columns Type, Name, Supplier, and View. One row is shown: Test category, Test Material, Test Material supplier, and View.
- Structures**: A table with columns Type, Name, Supplier, and View/Edit. One row is shown: Test structure category, name of the structure, name of the structure suppliers, and View/Edit.

Figure 4-13 – Catalogue for Eco-Innovation Structures and Materials for Ship Retrofit

In the upper right corner you will find the “Add new structure into the DB” and the “Add new material into the DB” buttons.

By clicking on one of the buttons, a step-by-step wizard will be launched.

Figure 4-14 – Wizard for adding a new material for ship retrofit – Step 1

In the **first step**, the user has the option to choose an existing structure/material or if there is the need to add a new structure/material which is not present in the dropdown list, it can be added in the provided field below the drop-down box.

Please note that if you add a new type of structure/material, in the first phase it will have the status of “proposed”. This is done in order to assure that only reliable data is introduced. The approval is given by the administrator of the database, while in the meantime the user can proceed to the next step.

If at this **first step** there is no selection, or the proposal of a new structure/material category, an error will be displayed and you will not be able to proceed to the next step.

In the **second step**, the user is able to input detailed information for the structure/material. The first part of the page shows a note with a few instructions on how to fill the form.

In addition, as the new structure/material is added, a direct link to the information is provided, allowing the user the possibility of returning at any time to edit the information he or she supplied to the database.

Note: The users can edit only the information that was entered from their account.

The screenshot shows a web-based application interface for adding a new material. At the top, there is a navigation bar with links: Overview, Database Catalogue, Best practices, Value Engineering, and Panel of Experts. Below the navigation bar, the title "Add a new material for ship retrofit" is displayed. A sub-section titled "Step 2: Please enter the information regarding the material" contains several instructions and notes:

- Please note:**
- If you could not find a proper field where to insert the information, please press on the add new field button and proposed another field.
- If you just added a new category of materials it is possible to don't have any available fields. Please be free and propose fields for this category of materials.
- You can come back to this item in order to continue editing it by typing the following address:
<http://92.55.144.224/ecorefitec/index.php?task=addmodule&step=2&id=4&passkey=b23bff20bb00ef3555d2918eb181da7c>

Below these instructions, there are two input fields labeled "Name" and "Website URL", each with a corresponding text input box. At the bottom of the form are two green buttons: "Save" on the left and "Add new field" on the right.

Figure 4-15 – Wizard for adding a new material for ship retrofit – Step 2

In the second part of the page, the chosen structure/material category will be displayed. Next there will be a series of available properties to be filled. The properties are generated automatically based on the structure/material description template.

The structure/material description template contains the list of recommended fields necessary for uploading a structure/material. This template is dynamic, and the user could request to add a new field. If the administrator approves this, the field will be added to the template of the specific structure/material category.

In order to add a new field, you simply need to click on the "Add new field" button from the lower right corner of the form. When you press the button, the initial form will be extended and the "Add new field" form will be displayed.

Add a new field

Field name:

Required:
 Yes No

Description:

Value:

Save **Add new field**

Figure 4-16 – Wizard for adding a new material for ship retrofit – Step 2 – Add new field

In the “Field name” text box you need to enter the property name. Following this, you need to choose if this property/field is mandatory to be filled or not for the other structure(s)/material(s). There is also a box provided for the description of the property. The value field is optional, but if you type a value it will be saved. This value can be edited later, as well.

For example, if the new property is “Approval date”, the description should be detailed such as “The date of approval by IMO”, and the value could be “10/22/2012” or “10.22.2012”.

If you want to save the information entered you should press the “Save” button from the lower-left corner of the form.

4.2.2.3 Add new module

When logged in, go to the “Database Catalogue” and from the drop-down list choose the “Eco-Innovation Modules for Ship Retrofit”.

Module type	Module name	Supplier	
Balast Water Management System	Electro-Cleen	TECHCROSS INC	View
Balast Water Management System	SEDNA BWMS	Hamann AG / Degussa GmbH (withdrawn from the market)	View

Eco-Innovation Modules for Ship Retrofit

Add a new module into the DB

Figure 4-17 – Catalogue for Eco-Innovation Modules for Ship Retrofit

In the upper right corner you will find the “Add new module into the DB” button.

By clicking on it a step-by-step wizard will be launched.

Figure 4-18 – Wizard for adding a new module for ship retrofit – Step 1

In the **first step**, the user has the option to choose an existing module or if there is the need to add a new module which is not present in the dropdown list, it can be added in the provided field below the drop-down box.

Figure 4-19 – Wizard for adding a new module for ship retrofit – Step 1 – Choose a category

Please note that if you add a new type of module, in the first phase it will have the status of “proposed”. This is done in order to assure that only reliable data is introduced. The approval is given by the administrator of the database, while in the meantime the user can proceed to the next step.

If at this **first step** there is no selection, or the proposal of a new process category, an error will be displayed and you will not be able to proceed to the next step.

In the **second step**, the user is able to input detailed information for the module. The first part of the page shows a note with a few instructions on how to fill the form.

The screenshot shows a web-based application interface. At the top, there is a navigation bar with five items: Overview, Database Catalogue, Best practices, Value Engineering, and Panel of Experts. Below the navigation bar, the main content area has a title 'Add a new module for ship retrofit' and a downward-pointing arrow icon in the top right corner. A bold section header 'Step 2: Please enter the information regarding the module' is followed by a 'Please note:' section. This note contains three bullet points: 1) If you could not find a proper field where to insert the information, please press on the add new field button and proposed another field. 2) If you just added a new category of modules it is possible to don't have any available fields. Please be free and propose fields for this category of modules. 3) You can come back to this item in order to continue editing it by typing the following address: <http://92.55.144.224/ecorefitec/index.php?task=addmodule&step=2&id=3&passkey=7a3091388a6dc6ee0630902494e0130b>

Figure 4-20 – Wizard for adding a new module for ship retrofit – Step 2

In addition, as the new module is added, a direct link to the information is provided, allowing the user the possibility of returning at any time to edit the information he or she supplied to the database.

Note: The users can edit only the information that was entered from their account.

In the second part of the page, the chosen module category type will be displayed. Next there will be a series of available properties to be filled. The properties are generated automatically based on the module description template.

The module description template contains the list of recommended properties necessary for uploading a module. This template is dynamic, and the user could request to add a new property. If the administrator approves this, the property will be added to the template of the specific module category.

Category: Balast Water Management System

Module name

BWMS Manufacture

Country

Process

Website URL

The date when it was commercially available

Units installed

Projected Production units

Approval resolution by IMO for Active Substances Method - Basic

The date for active substance - Basic approval

Approval resolution for Active Substances Method - Final Approval by IMO

The date for active substances method - final approval by IMO

The Date for Landbased System testing

The Date for Shipboard System testing

Test site

The Date for Type Approval Certificate

Approval by Administration of

withdrawn from the market?

Figure 4-21 – Wizard for adding a new module for ship retrofit – Step 2 – Fields

In order to add a new field, you simply need to click on the “Add new field” button from the lower right corner of the form. When you press the button, the initial form will be extended and the “Add new field” form will be displayed.

Add a new field

Field name:

Required:

Yes No

Description:

Value:

Save **Add new field**

Figure 4-22 – Wizard for adding a new module for ship retrofit – Step 2 – Add a new field

In the “Field name” text box you need to enter the property name. Following this, you need to choose if this property/field is mandatory to be filled or not for the other modules. There is also a box provided for the description of the property. The value field is optional, but if you type a value it will be saved. This value can be edited later, as well.

For example, if the new property is “Approval date”, the description should be detailed such as “The date of approval by IMO”, and the value could be “10/22/2012” or “10.22.2012”.

If you want to save the information entered you should press the “Save” button from the lower-left corner of the form.

4.2.2.4 Database search engine

In order to search the database for information, the users have the possibility to use the Database Search Module, which is available for all users (registered or visitors).

This module can be found by accessing the “Database Catalogue” menu and choosing the “Database Search Engine” item.

Overview Database Catalogue Best practices Value Engineering Panel of Experts

Database Search Engine

Search word

Catalogue:

All Catalogues

Search

Figure 4-23 – Database search engine form

As shown in the picture above, you can search in the database by typing a keyword in the search box. The default setting is for searching in the entire database, while also the user has the option to filter the search to processes, modules, and structures and materials.

For the search, some special characters can be used within the keyword to replace unknown letters or words, to act as wildcard characters.

One of the symbols that can be used is “*” (asterisk or star), if you do not know part of the word or the entire word (e.g. if you want to search “ballast”, you can use also “ba*ast”, or if you search “ballast water equipment”, you can use “ballast * equipment”).

Another symbol is “?”, which can be used to replace one letter only (e.g. if you want to search “ballast”, you can use “bal?ast”).

4.2.3 BEST PRACTICES

In this section, information in different formats can be found, uploaded by registered users, and mostly regarding the best practices for processes, structures and materials, and modules.

4.2.3.1 Add a new best practice

When logged in, go to “Best practices”. In the upper right corner you will find the “Add new best practice” button. The wizard will be launched.

In this section, the registered user has the option to write a best practice in a web text editor, or to upload a document related to the best practice.

In the first step, the user needs to enter administrative information related to the best practice, including the organization which implemented it, location where it was implemented, time period when it was implemented, and a short description.

In the second step, the user should add detailed information related to the best practice. This can be added in a web text editor, or in the form of a document which can be uploaded.

After the user presses the “submit” button, the best practice submission will be saved into the database, and will have the status of “proposed”. The administrator of the database, in collaboration with the Panel of Experts, will analyze the proposal and will validate or dismiss it.

4.2.4 VALUE ENGINEERING

In the first part, a tutorial can be found regarding the general introduction for Value Engineering, and the approach that has been used.

In the second part, the tool displayed can perform the value analysis of the existing processes, modules, and materials and structures found in the database.

In order to access the tool, click on the “Value Engineering” menu. A wizard will be displayed.

In the first step, you need to define your priorities. The system will analyze your priorities and will calculate the weighting factors. Also the system will recommend a default set of values for the weighting factors which is calculated by using a learning loop algorithm, having the inputs the previous inputs for the weighting factors.

The weighting factor are calculated by using the “Analytic hierarchy process” (AHP) developed by Thomas L. Saaty, and it is based on a hierarchy of decisions and priorities. The hierarchy of decisions and priorities for the AHP will be defined in the deliverable D 2.2: “Value Engineering of Technological

Eco – innovation for ship retrofit” that will be delivered on month 30 (June 2013), and it is not the scope of this deliverable (D 2.3).

In the picture below we took as the example the hierarchy of decisions and priorities defined for processes in the draft version of the D 2.2.

Show Explanations

Choose Your First Level Criterias!

Economic	<input checked="" type="checkbox"/>
Environmental	<input checked="" type="checkbox"/>
Operating	<input checked="" type="checkbox"/>
Organizational	<input checked="" type="checkbox"/>

Next Step Reset

This is just a temporary draft!

Figure 4-24 – The first level of criteria for the choosing of weighting factors

Show Explanations

Second Level decision!

Criteria	Economic	Environmental	Operating	Organizational
Economic	Equal Importance	-	-	-
Environmental		Equal Importance	-	-
Operating			Equal Importance	-
Organizational				Equal Importance

Back **Next Step**

This is just a temporary draft!

Figure 4-25 – The user needs to choose the importance of each criteria on the level 2 of the hierarchy by using a grading system

Grading system!

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Moderate importance	Experience and judgment strongly favor one activity over the another
5	Essential importance	Experience and judgment strongly favor one activity over the another
7	very strong importance	An activity is strongly favored and its dominance demonstrated in practice
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2	Equal or Moderate importance	When compromise is needed
4	Moderate or Essential importance	When compromise is needed
6	Essential or very strong importance	When compromise is needed
8	very strong importance or extreme importance	When compromise is needed

This is just a temporary draft!

Figure 4-26 – The values of the grading system and its definition and explanation

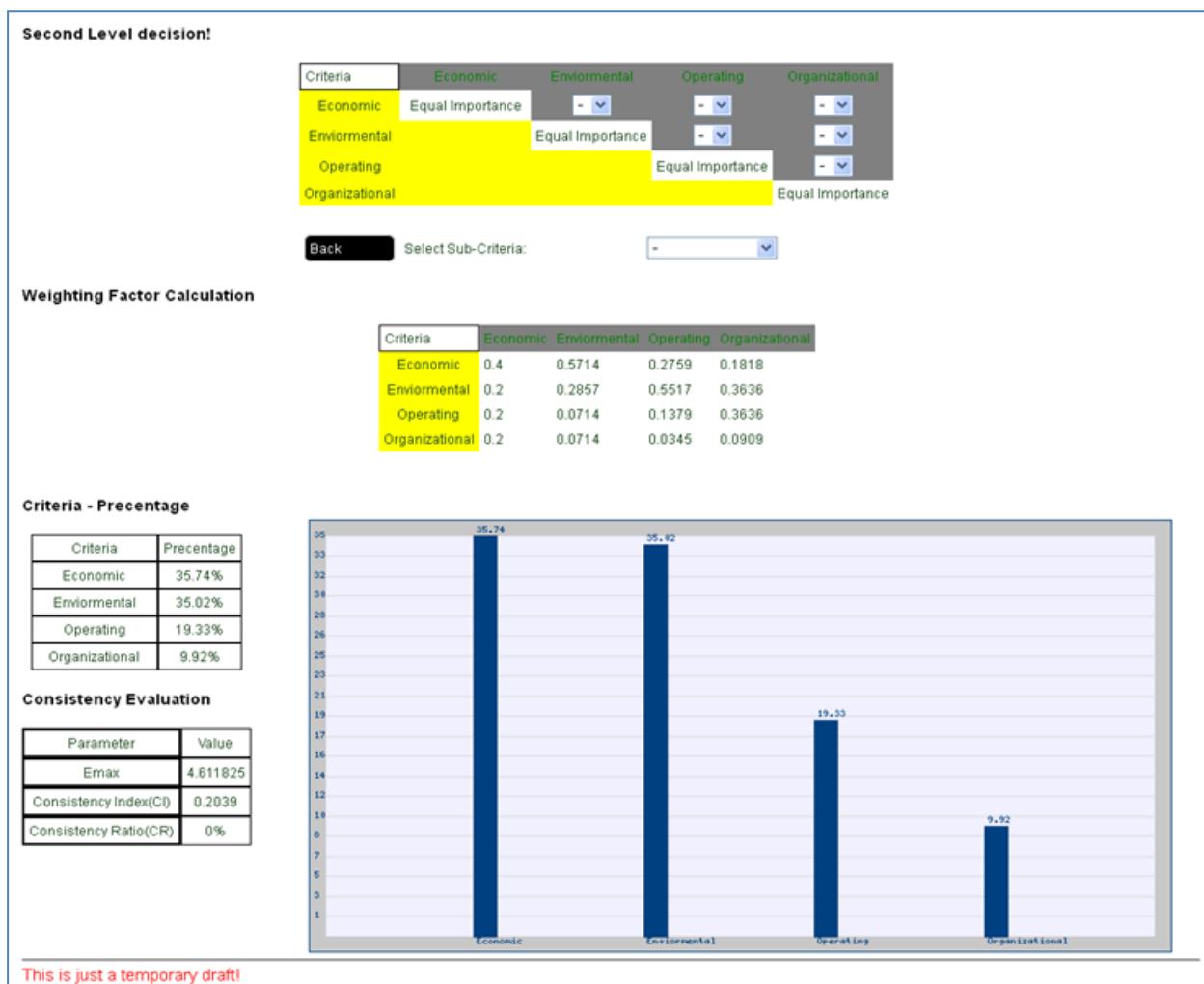


Figure 4-27 – The values calculated by the system for the second level of the hierarchy

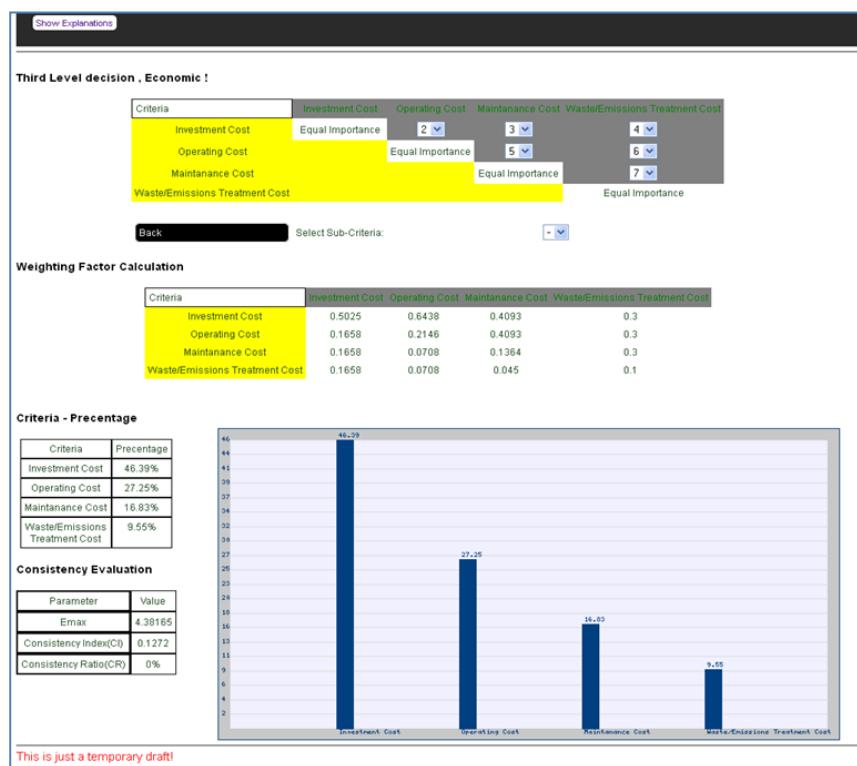


Figure 4-28 – The third level of decision for the economic criteria

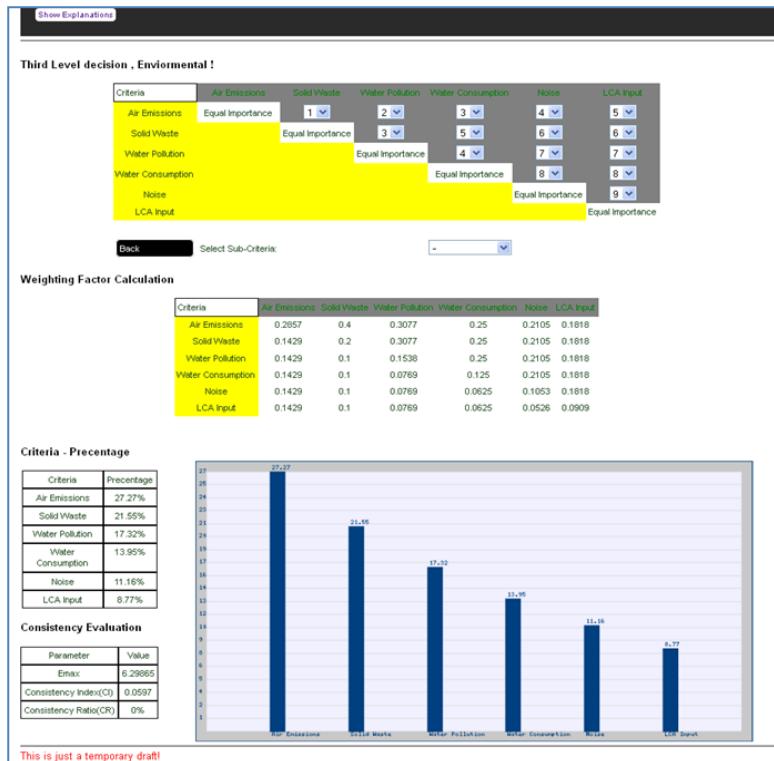


Figure 4-29 – The third level of decision for the environmental criteria

Show Explanations

Third Level decision , Operating !

Criteria	Compliance With Standards	Health and Safety	Logistics
Compliance With Standards	Equal Importance	1 ↓	3 ↓
Health and Safety	Equal Importance	5 ↓	
Logistics	Equal Importance		

Back Select Sub-Criteria: -

Weighting Factor Calculation

Criteria	Compliance With Standards	Health and Safety	Logistics
Compliance With Standards	0.3333	0.3333	0.3333
Health and Safety	0.3333	0.3333	0.3333
Logistics	0.3333	0.3333	0.3333

Criteria - Percentage

Criteria	Percentage
Compliance With Standards	33.33%
Health and Safety	33.33%
Logistics	33.33%

Consistency Evaluation

Parameter	Value
E _{max}	2.9997
Consistency Index(CI)	-0.0001
Consistency Ratio(CR)	0%

This is just a temporary draft!

Figure 4-30 – The third level of decision for the operating criteria

Show Explanations

Third Level decision , Organizational !

Criteria	Labour Skill Requirements	Legislative Requirements	Dependence on Contractors
Labour Skill Requirements	Equal Importance	1 ↓	2 ↓
Legislative Requirements	Equal Importance	3 ↓	
Dependence on Contractors	Equal Importance		

Back Select Sub-Criteria: -

Weighting Factor Calculation

Criteria	Labour Skill Requirements	Legislative Requirements	Dependence on Contractors
Labour Skill Requirements	0.3333	0.3333	0.3333
Legislative Requirements	0.3333	0.3333	0.3333
Dependence on Contractors	0.3333	0.3333	0.3333

Criteria - Percentage

Criteria	Percentage
Labour Skill Requirements	33.33%
Legislative Requirements	33.33%
Dependence on Contractors	33.33%

Consistency Evaluation

Parameter	Value
E _{max}	2.9997
Consistency Index(CI)	-0.0001
Consistency Ratio(CR)	0%

This is just a temporary draft!

Figure 4-31 – The third level of decision for the organizational criteria

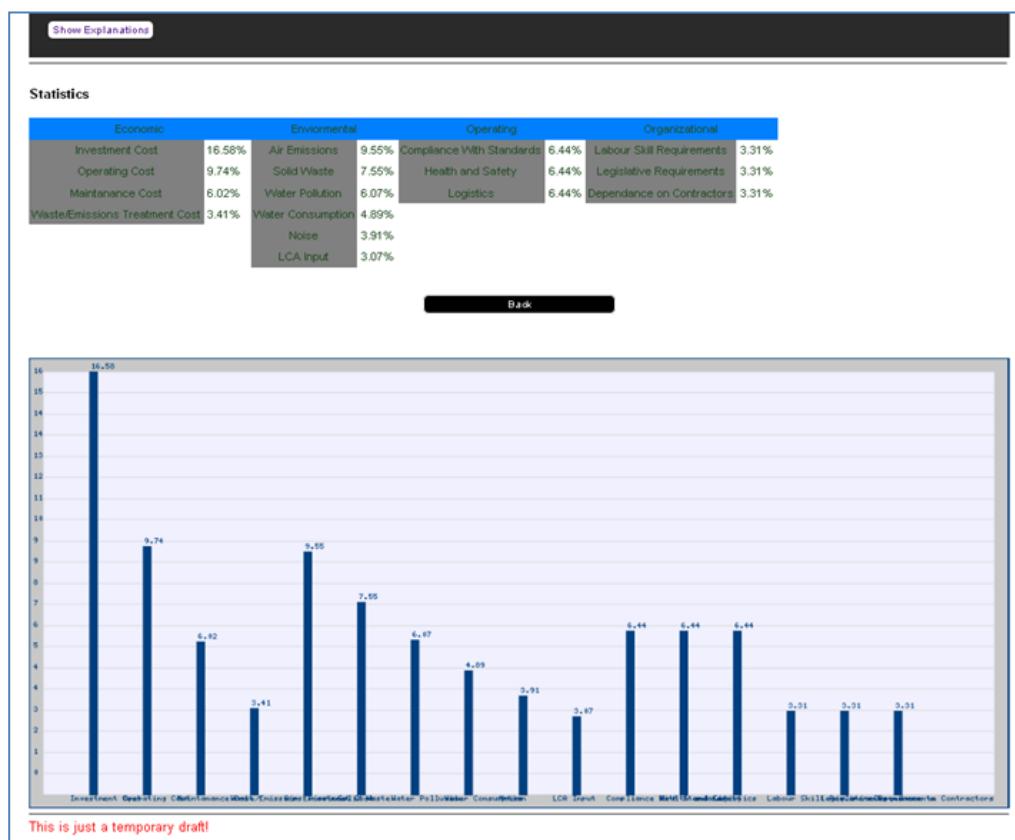


Figure 4-32 – The final solution for the weighting factors

By using this weighting factors the system can display a list of items, ordered, based on the most suited criteria for the user.

Process category	Process	Supplier	Equipment	
Coating	Airless System	O-Gee Paint	AIRLESSCO LP400 - 240v Airless Sprayer	View
Coating	Airless System	Anest-Iwata	ALS 663 + Airless Spray Gun	View
Coating	Airless System	Asturo Originali Maves	Asturo K 45	View
Coating	Airless System	Ecco	Ecco Hydric LF 1057 HD	View
Coating	Airless System	Airlessco HSS Series	GAS hydraulic Airless Paint Sprayers - HSS11000	View
Coating	Airless System	Titan Tool International	IMPACT 1640 1.30 GPM Electric Piston Pump	View
Coating	Airless System	Hi-Tec Spray Paint Equipment	NXT Xtreme Airless Sprayers	View

Figure 4-33 – An example of the list of items



4.2.5 PANEL OF EXPERTS

In order to access this section, click on the “Panel of Experts” menu.

In this section, short information about the involved experts can be found, and a read only forum for unregistered users. The experts can edit their own public information.

In the case of registered users, the page offers the possibility to contact the experts by using the contact form provided for each expert.

The section offers a discussion forum where registered users can post opinions, questions, facts, ideas and others.

In order to access the forum, you need to click on the “Forum” button on the lower right corner of the section, or choose from the “Panel of Experts” menu the “Forum” menu item.

4.2.6 NEWSLETTER

In order to access this section, click on the “Newsletter” menu.

Here the registered users can access the archive of periodic newsletters or to subscribe to the newsletter mailing list, to receive the newsletter by e-mail. The subscription form can be found in the right side of the page under the login form, and is available to all users, registered or not.

In order to subscribe, you need to write your name and your e-mail address in the designated boxes and press the “submit” button.

Figure 4-34 – The archive of newsletters

4.2.7 TOOLS

This section offers tools for importing and exporting data from the database in the form of xml files.

For this, go to the “Tools” menu, and depending on your user right access, you can import or export data.

The export function is available for both registered and unregistered users, and is displayed in the top part of the tools page.

The web application can export the information from the database in xml format. The user has the possibility to choose which information they want to export by selecting it from the menu tree, from the left side of the page.

After the information is selected, press the “xml” button to export.

The import function is available only for registered users, as the information that will be imported needs to be checked by the administrator. Until approved, the information is not available to the public. The imported data needs to be in xml format.

4.2.8 SURVEY

In order to access this section, click on the “Survey” menu.

This page is dedicated to the Eco-REFITec Data Base design survey. It contains background information and the objectives of the Eco-REFITec project and the aim of the database. Here the users have the possibility to subscribe to the newsletter by clicking the “Subscribe to Newsletter” button.

Eco-REFITEC Data Base design Survey

ECO-REFITEC DB Design Survey

Background

Due to the IMO and EU recently developed measures to prevent pollution from ships and shipyards respectively, such as those aimed at reducing atmospheric pollution and addressing climate change and global warming, the European Repair Shipyards are facing a major challenge.

The retrofitting options and environmental upgrades of existing vessels are certain to form an increasingly significant component of additional work within what is already a very buoyant and competitive sector. However, the ability of the European shiprepair sector to meet the needs of the shipping industry cannot be taken for granted.

Efforts in research, development and innovation (RDI) are needed as key drivers of success, it is a powerful instrument to improve products and processes, to maintain the technology bases and to ensure the proper level of skilled people to work in the maritime sector. By using the technological knowledge (eco-innovation process) that it is already available in Europe (not only in the waterborne sector), repair shipyards will be more competitive and it will allow to keep and increase their market share.

Objectives

The overall objective of ECO-REFITEC project is to improve the competitiveness of the European shipyards and SME's involved in shipbuilding, shiprepair & recycling.

As ship owners and operators have to focus much more on to adopt measures to prevent or reduce any pollution from ships (new and existing), ECO-REFITEC project aim to develop IT supported tools for retrofit impact evaluation on ship life cycle cost, energy, environmental performance and safety; and to identify/develop/explore eco-retrofitting technologies and solutions for existing fleet to comply with some current and future IMO standards.

In addition, as the industry has to fulfil a wide range of constantly increasing requirements in the scope of environmental legislation and regulation, ECO-REFITEC aims also to provide practical and cost effective solutions to major environmental problems associated to the new eco-innovative process to be carried out in ship retrofitting activities in European repair shipyards.

Aim

The aim of the ECO-REFITEC project WP2, is to identify technological eco-innovation solutions (processes, materials and modules) that might be of relevance to improving the performance of ship repair industry, especially to address the future retrofit activities to be carried out in small & medium size shipyards.

The specific objectives of this work package include the development of a ECO-REFITEC Database (ERLCA - DB) taking into account the selected types of vessels analyzed, which are relevant both for European shipping companies and shipyards and the development of tools for data base operation and updating.

In order to conceive the features of the eco-refitec database we are kindly asking you to help us with your opinion.

We need your insight, so please take a few minutes to tell us what you need from the Eco-Refitec Database.

TAKE PART IN THE SURVEY

Figure 4-35 – The overview of the eco-REFITec Database Design Survey

In order to fill the questionnaire of the survey campaign, click on the “Take Part in the Survey” button. By clicking the button, you will be redirected to the survey website.

Figure 4-36 – The first page of the eco-REFITec Database Design Survey

The user guide for filling the survey form is displayed step by step on the survey webpage.

4.2.9 ACCOUNT SETTINGS

In order to experience full access to the database and its tools, the users need to login by means of a username and a password, which are provided by the administrator of DB Web Access.

Figure 4-37 – The login form

If the login is unsuccessful, an error will be displayed:

The image shows a login interface with a blue header bar containing the word 'Login' and a lock icon. Below the header is a red error message: 'Incorrect username and password!'. There are two input fields labeled 'User:' and 'Password:', each with a small placeholder box. At the bottom is a grey 'LOGIN' button.

Figure 4-38 – Incorrect username and password

When the users are logged into the DB Web Access, a welcome back message appears:

The image shows a 'Welcome back' screen with a blue header bar containing the message 'Welcome back' and a lock icon. Below the header is a message: 'You are successful logged in as Laurentiu Oancea'. At the bottom are two blue buttons: 'Account Settings' on the left and 'logout' on the right.

Figure 4-39 – You are successful logged in

In the first phase of the registration on the DB Web Access, the users are given a default username and password. After the login, the users have the possibility to update their information by accessing the Account Settings option, located in the lower left corner of the login box.

By pressing the Account Settings button, there is opened the Account Settings page, where users have the possibility to change their name, username, password and additionally have the option to input or change information regarding their e-mail, organization and CV. The e-mail, organization and CV are by default left blank, as the users have the option to add more data or not.

The image shows the 'Account Settings' page with a blue header bar containing the title 'Account Settings'. The main content is a table with six rows, each representing a piece of user information: Name, Username, Email, Password, Organization, and Short CV. Each row has a text input field on the left and a 'Change' button on the right. The 'Name' field contains 'Laurentiu Oancea', the 'Username' field contains 'loancea', and the 'Email' field is empty. The 'Password' field contains '*****', the 'Organization' field is empty, and the 'Short CV' field is empty. A small downward arrow icon is located in the top right corner of the table area.

Figure 4-40 – Account Settings page

In order to change a field, it is necessary to press the Change button in the right side of each field. When pressed, a submenu will be displayed, which will give the possibility to change the existing data and will ask users to input the password. This is done in order to prevent the change of user information from stations left unattended.

Account Settings		
Name	Claudiu Fercu	Change
Username	fercu	Change
Email	Email: <input type="text" value="cfercu@univ-ovidius.ro"/>	Change
	Enter your password: <input type="password"/>	
	Save Changes	
Password	*****	Change
Organization	"Ovidius" University of Constanta	Change
Short CV	Claudiu Fercu is an assistant researcher specialized in computational mathematics and modern information technology, with a considerable portfolio in the development of databases, technical applications and e-learning platforms. The main skills that define him are: design and maintenance of databases (MySQL, Microsoft SQL Server, Access, Visual Fox Pro), web programming (HTML, JavaScript, PHP, ASPX, XML), programming languages (Pascal, C, C++, C#, Java), developing applications for RFID systems in C# and Microsoft Access/SQL Server databases, developing applications for mobile devices using C# (.NET Compact Framework) connected to web services.	Change

Figure 4-41 – Account Settings Page – Change the e-mail address

To save the new information just presses the “Save Changes” button.

5 Assessment of Data from the Database

The Eco-Refitec Database has been designed to include the following classes of data flows:

5.1 Proprietary Data

This represents the data related to the equipment, products and tools used in ship repair processes, modules, materials and structures. The owners of these data are the producers of the equipment, products and tools. We expect that most of the producers will be SMEs belonging to the supplying industries to the shipbuilding and ship repair sector, which want to aware the possible customers about their products.

The values associated to characteristics and the properties of the equipment, products and tools are the self responsibility of the producers, which based on a self declaration, can include their data into the Eco-Refitec Database. However, their inputs will be sent to validation to the Eco-Refitec Database Committee² which has the role to accept or reject the inputs sent by the producers. Also the committee could request to the producers of equipment, products and tools to give more details about their inputs.

It is estimated that this type of dataflow will represent somewhere between 40% and 60% of the Eco-Refitec Database.

5.2 Public Data

This class of dataflow can include public data about components and standards used for the components in the ship repair and shipbuilding sector.

These types of data are usually public, but we identified that different data sources offers different values. In this respect we need to classify the data source according to an index of trust. This index of trust is initially set according to the number of references to the data source, and can be increased if more references are provided or the Eco-Refitec users are marking that the data source is trustful or can be decreased if the Eco-Refitec users are marking that the data source is not trustful. As an example the data that is coming from the American Chemistry Council will have a very high index of trust, but the data that is coming from a student that is preparing his thesis and prepared a website on that topic will have a very low index of trust.

This type of data is periodic checked for consistency by the Eco-Refitec Database Committee, which has the role to increase or decrease the index of trust, and even to remove some data from the Eco-Refitec Database.

5.3 Eco-Refitec Project Data

The data that is coming from the Eco-Refitec Project case studies it will be included into the Eco-Refitec Database on the self responsibility of the case study developer.

The role of the Eco-Refitec Database Committee it will be to develop periodic analyses on the case studies in order to choose a number of case studies of reference, with the role to validate the other case studies that will be included into the Eco-Refitec Database.

As an example let us consider that, for the value analysis of the Ballast Water Treatment Plant, we need to have a reference case and other partners responsible to the Ballast Water Treatment Plant case studies will repeat the same type of the case study with the same values. In this way this case studies will become test cases.

² In the structure of the Eco-Refitec Database Committee are included all the partners of the Eco-Refitec Task 2.6 (SOERMAR, CTO, AES, SU, KU, SSA, ISQ, CONSAR) together with the Group of Experts under the coordination of CAES.

6 The actual content of the Database

The database is continually expanding and more items will be available soon, depending on the case studies that will be developed in the Eco-Refitec project and on the data inserted by users.

As an example of what data can be found in the database please check the tables below:

Table 1: Example of Coating Processes included in the data Base

Type	N	Process	Producer	Equipment
Coating	1	Air Spray	Titan Tool International	Commander 45:1
	2	Airless System	O-Gee Paint	AIRLESSCO LP400 - 240v Airless Sprayer
	3	Airless System	Anest-Iwata	ALS 663 + Airless Spray Gun
	4	Airless System	Asturo Originali Maves	Asturo K 45
	5	Airless System	Ecco	Ecco Hydric LF 1057 HD
	6	Airless System	Airlessco HSS Series	GAS hydraulic Airless Paint Sprayers - HSS11000
	7	Airless System	Titan Tool International	IMPACT 1140 1.20 GPM Electric Piston Pump
	8	Airless System	Titan Tool International	IMPACT 1640 1.30 GPM Electric Piston Pump
	9	Airless System	Hi-Tec Spray Paint Equipment	NXT Xtreme Airless Sprayers
	10	Electrostatic Airless Systems/Powder coating	Titan Tool International	1150e
	11	Electrostatic Airless Systems/Powder coating	MBP	MAGNUS 8000
	12	Electrostatic Airless Systems/Powder coating	Iso-Flo HD Voltage Block System for Waterborne Applications	Nordson
	13	Electrostatic Airless Systems/Powder coating	Lemmer Spray Systems Ltd.	VM2000 Portable system
	14	Heated Airless Systems/Thermal Spray	Metallisation	Arcspray 140/S350-CL
	15	Heated Airless Systems/Thermal Spray	Metallisation	Arcspray 170-CL
	16	Heated Airless Systems/Thermal Spray	Metallisation	Arcspray 701-CL
	17	Heated Airless Systems/Thermal Spray	FLAME SPRAY GUN MODEL IMC-95	Industrial Metal Components
	18	Heated Airless Systems/Thermal Spray	Deloro Stellite	Jet Kote III
	19	Heated Airless Systems/Thermal Spray	Metallisation	MK61 Wire Flame
	20	Heated Airless Systems/Thermal Spray	Metallisation	MK73 Wire Flame

Table 2: Example of Cutting Processes included in the data Base

Type	N	Process	Producer	Equipment
Cutting	1	Cutting Disc	Bosch	GCO 2000
	2	Laser Cutting	Multicam	2000 Series CNC Laser
	3	Laser Cutting	Adira	ADIRA LP Laser Cutting Machines
	4	Laser Cutting	Bodor CNC	BCL500FB CNC Fiber 500W
	5	Laser Cutting	Sponge-Jet	C-YAG-500-3000x1500
	6	Laser Cutting	Thermal Arc Fabricator 181i	CO2 Laser
	7	Laser Cutting	Coherent	Diamond K-250
	8	Laser Cutting	Hypertherm	HyIntensity Fiber Laser HFL015
	9	Laser Cutting	JQ Laser	JQ 500
	10	Plasma Cutting	Thermal Dynamics	Cutmaster A80 Plasma Cutter with Machine Torch
	11	Plasma Cutting	ESAB	ESP 150
	12	Plasma Cutting	ESAB	PowerCut 1600
	13	Plasma Cutting	ESAB	PowerCut 900
	14	Plasma Cutting	Miller	Spectrum 125C
	15	Plasma Cutting	Miller	Spectrum 875
	16	Plasma Cutting	Miller	Spectrum 875 Auto-Line
	17	Plasma Cutting	Lincoln Electric	Tomahawk 1000 Plasma Cutter with Machine Torch
	18	Water Jet Cutting	Retro Systems, LLC	AS-60150 150 HP Pump
	19	Water Jet Cutting	Hi-Tec Spray Paint Equipment	HDP 44 High Pressure Triplex Pump
	20	Water Jet Cutting	Multicam	V-Series CNC WaterJet

Table 3: Example of Others Processes included in the data Base

Type	N	Process	Producer	Equipment
Laminating	1	Laminating	Vénus Gusmer	H.I.S
Surface Preparation	1	High pressure washing surface	Kranzle	Kranzle HD 15/200
Surface Preparation	2	Sponge Blasting	Sponge-Jet	Xtreme (Riding) Team™
Welding	1	Flux cored arc welding (FCAW)	Thermal Arc Fabricator 181i	W1003181
	2	Shielded metal arc welding (SMAW)	ESAB	Caddy™Arc 251i
	3	Shielded metal arc welding (SMAW)	Hobart	Stickmate® LX 235 AC / 160 DC
	4	TIG welding	Lincoln Electric	Invertec® V311-T AC/DC TIG Welder

Table 4: Example of Modules /Equipment/Systems included in the data Base

Type	N	Equipment Name	Producer
Ballast Water Management System	1	AquaStar	AQUA Eng. Co., Ltd.
	2	ARA Ballast	21st Century Shipbuilding Co., Ltd.
	3	BalClor BWMS	SunRui Marine Environment Engineering Company
	4	Ballast Master ecoP	GEA Westfalia Separator Group GmbH
	5	Ballast Master ultraV	GEA Westfalia Separator Group GmbH
	6	BalPure BWMS	Severn Trent DeNora
	7	Blue Ocean Shield	COSCO Shipbuilding Industrial Campany
	8	BlueSeas	Envirotech and Consultancy Pte. Ltd.
	9	BlueWorld	Envirotech and Consultancy Pte. Ltd.
	10	BSKY BWMS	Wuxi Brightsky Electronic CO., Ltd.
	11	BWMS with Peraclean Ocean(SKY- System)	Katayama Chemical, Inc.
	12	CleanBallast	RWO
	13	ClearBallast	Hitachi Plant Technologies, Ltd.
	14	DESMI Ocean Guard	DESMI Ocean Guard Ballast Water Treatment System
	15	DMU OH BWMS	Dalian Marine University

Table 4: Example of Modules /Equipment/Systems included in the data Base

Type	N	Equipment Name	Producer
	16	EcoBallast	Hyundai Heavy Industries Co. Ltd.
	17	Ecochlor BWT System	Ecochlor, INC.
	18	EcoGuardian	Hanla IMS Co., Ltd.
	19	Electro-Cleen	TECHCROSS INC
	20	En-Ballast	Kwang San Co. Ltd.
	21	ERMA FIRST BWMS	ERMA FIRST
	22	FineBallast OZ	Mitsui Engineering & Shipbuilding Co.,LTD.
	23	GloEn-Patrol	PANASIA CO., LTD.
	24	Greenship Sedinox Ballast Water Management System	Hamworthy Greenship
	25	HiBallast	Hyundai Heavy Industries Co. Ltd.
	26	Hyde GUARDIAN	Hyde Marine Inc.
	27	JFE BallastAce	JFE Engineering Corporation
	28	Kuraray Co., Ltd.	MICROFADE
	29	NEI Treatment Systems, LLC	Mitsubishi VOS System
	30	NK-O3 Blue	NK CO. LTD
	31	Ocean Protection System	MAHLE Industrial Filtration
	32	OceanGuard	Quindao Headway Technology Co., Ltd.
	33	OceanSaver	Ocean Saver AS
	34	Optimarin	Optimarin AS
	35	PureBallast 2.0	Alfa-Laval AB
Ballast Water Management System	36	Purimar System	Samsung Heavy Electronic CO., Ltd.
	37	Samsung Heavy Industries Co., Ltd.	SHI BWMS (Neo-Purimar)
	38	SEDNA BWMS	Hamann AG / Degussa GmbH
	39	SEI-BWMS	Sumitomo Electric Industries, Ltd.
	40	SHI BWMS (Neo- Purimar)	Samsung Heavy Industries Co., Ltd.

Table 4: Example of Modules /Equipment/Systems included in the data Base

Type	N	Equipment Name	Producer
	41	SiCURE BWM System	SIEMENS
	42	Smart Ballast	STX Metal Co., Ltd.
	43	Unitor Ballast Water Treatment System	Resource Ballast Technologies Pty. (Ltd.) / (UNITOR)
Cold Ironing (Shore to Ship Power)	1	CAVOTEC SEMI-FIXED AMP	CAVOTEC
	2	SIPLINK - SIEMENS	SIEMENS
	3	TEMPco	TEMCO

7 Final note

This user manual has been developed under the Eco-REFITec project – “Eco innovative refitting technologies and processes for shipbuilding industry promoted by European Repair Shipyards”, project reference: 266268, call ID: FP7-SST-2010-RTD-1, funded by the European Commission under the 7th Framework Programme.

As the project is ongoing and the database is under constant optimization, the user manual may change. For the updated version, please check the ERDB-LCA website, under “help” menu.

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